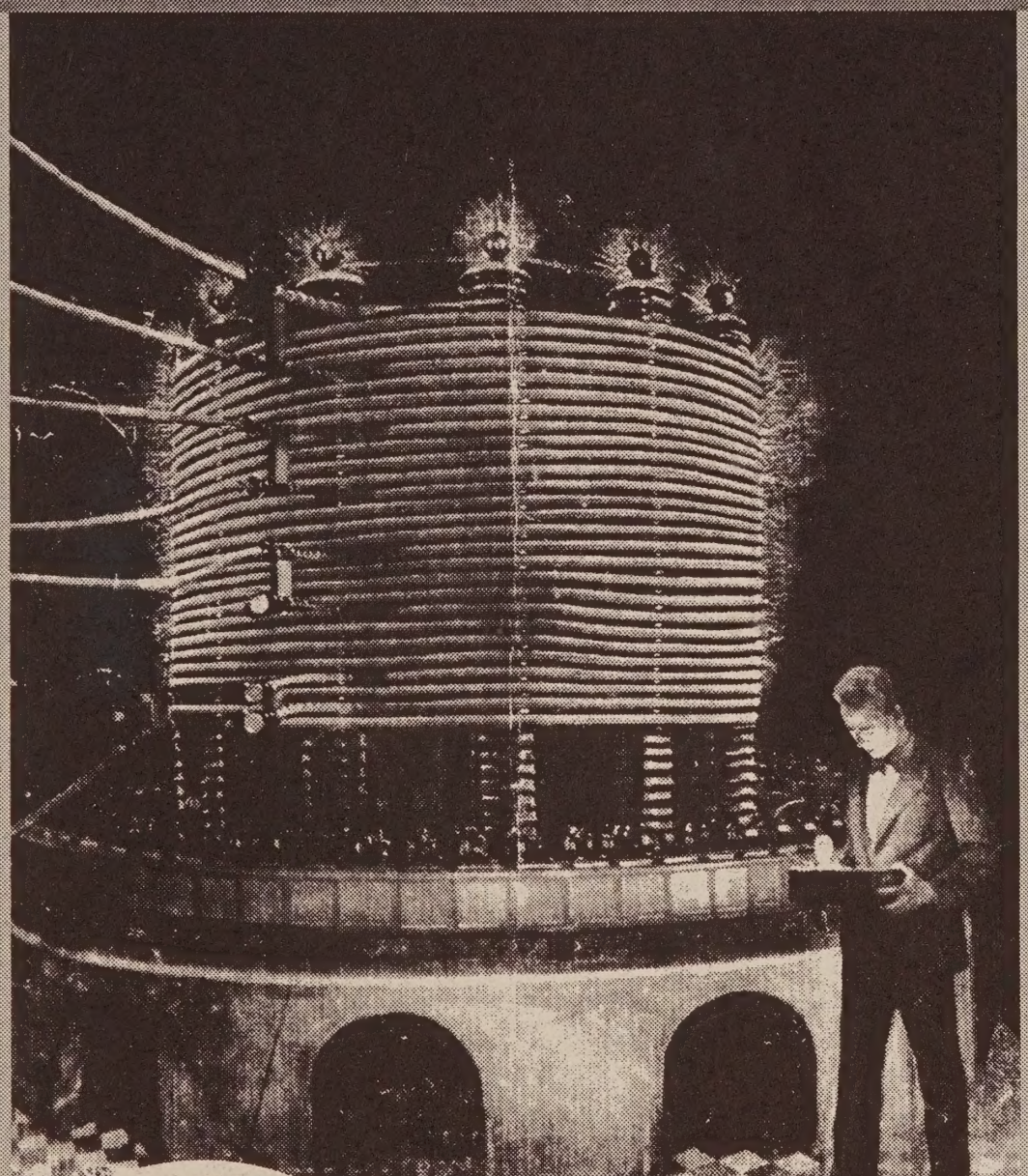
ARIZONA ANTIQUE RADIO CLUB NEWS



Vol XVII, No 1 Spring 2000

3 AARC News

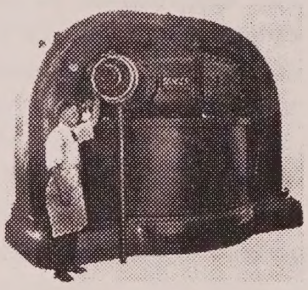
4 Early Wireless: Marconi was not Alone *by P. A. Kinzie*

14 The Lafayette Radio Station *by Harry Hyder*

20 Busted Bakelite *by Con Morton*

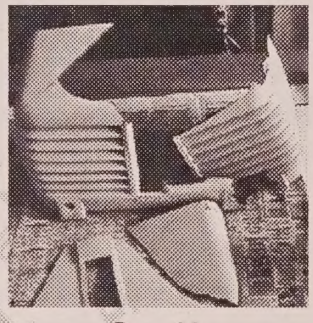
25 Classifieds

Page 4



Page 14

On the Cover:
Artwork based on the cover of the February 1921 issue of *Radio News*, "Inductance at Lafayette Station."



Page 20

ARIZONA ANTIQUE RADIO CLUB NEWS
Vol XVII, No 1 Spring 2000

Arizona Antique Radio Club

The Arizona Antique Radio Club was organized in 1983 for the preservation of the history and artifacts of radio and television, and for the advancement of knowledge and appreciation of radio technology and communication. The Club is a non-profit corporation organized primarily for the mutual assistance of radio devotees and collectors in Arizona. Membership, however, is open to any persons who have an interest in radio and television history, preservation, restoration, and collecting.

Meetings are held from October through May and consist of touring collections, presentations of technical, historical or restoration information, thematic displays of radios and the autobiographical experiences of the members. Our antique radio Swap Meets are scheduled for Spring and Fall meetings. Members of the Board of Directors are elected at the annual business meeting in May. Most meetings are held on Saturdays in the Phoenix and Tucson areas, and when possible, elsewhere within Arizona.

Membership dues are $18 (individual) or $20 (family) per calendar year and provide access to all club benefits including the quarterly issues of the *Radio Club News*. Send dues or membership inquiries to: **Arizona Antique Radio Club, 10513 E. Clinton, Scottsdale, AZ, 85259, phone (602) 860-8951.**

The Arizona Antique Radio Club News is the quarterly publication of the Arizona Antique Radio Club, Inc. It is mailed First Class to current members.

Contributions: submission of articles, news items, fiction, photographs and other materials relating to radio history and collecting are greatly appreciated, particularly if they have an Arizona connection. All members are encouraged to broaden their interest in the hobby by sharing their experiences, opinions, knowledge and observations with the club through its publication. Send materials for publication to **Arizona Antique Radio Club, 2025 E. LaJolla Dr., Tempe, Arizona, 85282-5910. Phone is 480-730-6058.** Email: **lettow@yahoo.com.**

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A.A.R.C. NEWS

AARC Elections

We held elections for the Board of Directors at our April meeting, held at Dave Lambert's home on the 15th.

This year the two year terms of David Cain, Dennis Craft, Dave Lambert, Con Morton and Corrine Wiltsie expired. Re-elected to the Board for new two year terms were David Cain, Dave Lambert and Con Morton. Also newly elected were George A. Fathauer, Larry Kenan and Carl Roberts.

George and Larry are charter members of the club, George having served as President before. Carl is the proprietor of Speakerworks, in Phoenix, and recently gave a program on the history of loudspeakers.

On June 10th, the new Board met to choose club officers. George A. Fathauer was chosen as President, Carl Roberts as Vice-President, Steve Smith will continue as Treasurer and Bill Lettow will continue as Editor.

Unfortunately the Board wasn't able at this meeting to select a Secretary. The functions of the Secretary are to keep minutes of meetings, maintain the list of members, and mail out the *Radio Club News* four times a year. The job isn't too taxing but does require someone who is good with details and has some computer skills. If you would be willing to volunteer for one or all of these tasks, or can suggest someone who would be, please let your club officers know as soon as possible.

The Board also began setting up a calendar which will begin with our first meeting in October. A tentative calendar will be published soon.

Writers Respond

Thanks go to P.A. Kinzie, Harry Hyder, Andy Ooms, Con Morton, and Al Sekela, all of whom submitted articles this summer for publication. Because of their contibutions we should be able to resume our regular journal publication schedule.

WA6NQO

We received word that Sterling R. Sanford, WA6NQO, a longtime club member from Tucson, passed away earlier this year. Our sympathies go out to his wife Marcia.

Early Wireless: Marconi was not Alone

by P. A. Kinzie

Guglielmo Marconi was the inventor of the first practical wireless communication system, and his contributions are well described in every good account of the development of radio. However, there were other men and companies, sometimes barely mentioned, that affected the beginnings of wireless and the direction of its progress. Such beginnings can be expressed in terms of the first speculation about transmitting information, early related inventions, or in any of a number of other ways. Here, a survey is made of the men that experimented, doing so with some expectation that wireless transmission of information might be possible. These contributors appear in Fig. 1., along with time lines of their activities.

As is shown in the figure, the first person describing experimental results was Professor C. A. Steinheil

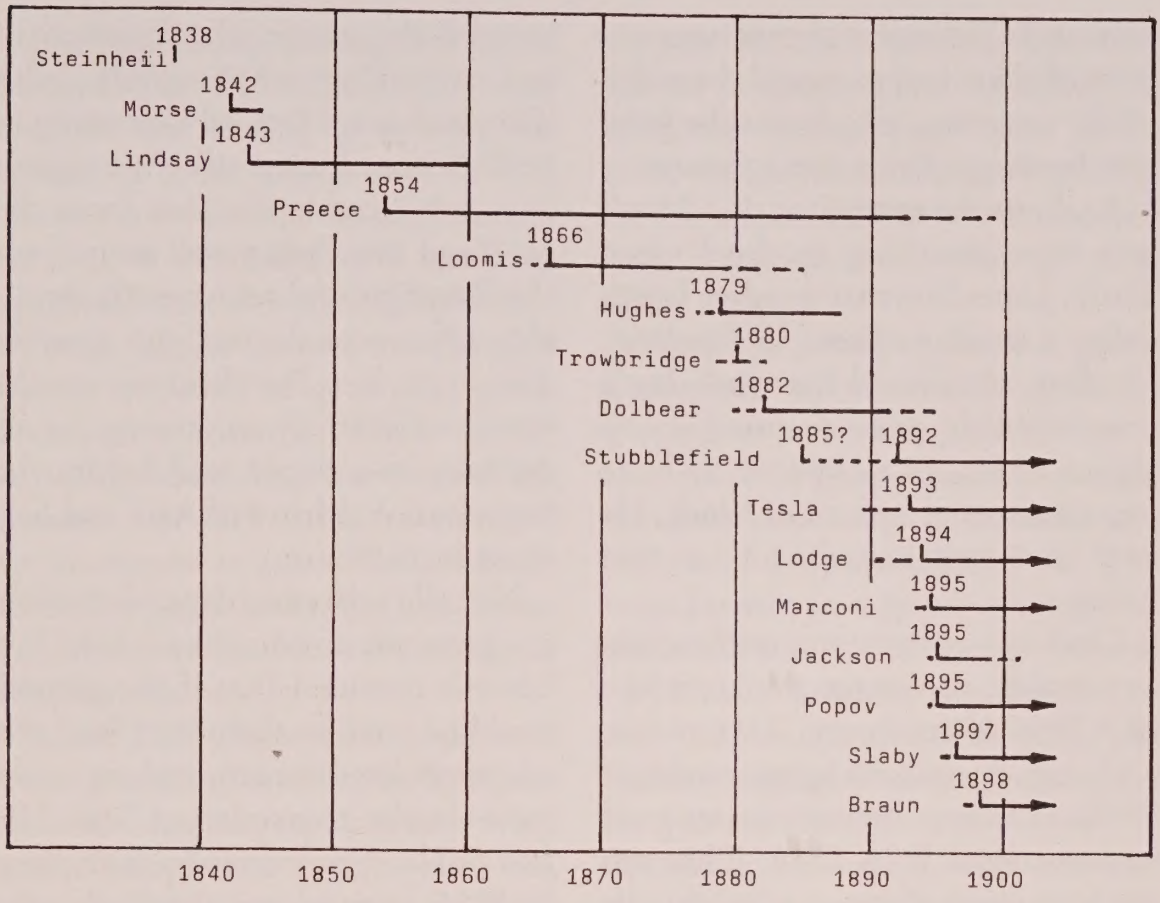


Fig. 1: Early investigators of wireless methods, listed in chronological order of initial activity.

in Germany, following his important discovery that the earth could be substituted for the return wire of a telegraph line. Previously everyone had assumed that two wires were necessary to complete the circuit. Steinheil detected weak currents in the ground below a telegraph line, with no direct electrical contact to the line itself. He was successful at distances up to 50 feet or so, using the primitive equipment available at that time. He suggested that higher power might improve the range.

About four years after Steinheil's work in 1838, Samuel F. B. Morse became interested in using water as a conductive medium, while trying to secure financial backing for his telegraphic invention. At the start of a demonstration with an underwater cable crossing a channel, a vessel weighed anchor, snagged the cable, and snapped it. This spoiled his demonstration, but caused him to consider using the water itself. He successfully transmitted across an 80-foot canal in December of 1842, and three years later extended the range to one mile.

The system used by Morse consisted of a telegraph key in series with a battery, connecting two copper plates at some distance apart along one shoreline. The receiver was a galvanometer connected between a pair of similar plates on the other shore. He found that the separation

distances between the connected pairs of plates had to exceed the width of the waterway, which was the great disadvantage of this arrangement.

At about the same time that Morse was experimenting in the United States, James Bowman Lindsay began using a similar system in England. Lindsay continued his work for a considerable period, possibly to about 1860, but appears to have been hampered by lack of funds. He may have transmitted as far as two miles.

Lindsay's system was sufficiently interesting to attract the attention of a British company. As a result, a young electrical engineer named William Henry Preece was assigned to investigate it in 1854. This was the beginning of experimentation by Preece, which took place at various times and locations over a period of many years. During that time Preece advanced in a career which later saw him become Engineer-in-Chief of the British Post Office.

During the earlier years of Preece's work, he improved upon the Lindsay system, and in his later versions included the use of interrupted direct current at the transmitter, and a telephone receiver at the other end, greatly improving sensitivity and range. It is not clear whether Preece was first in this respect, because in the 1880's and thereafter several investigators described the use of chopped DC, as well as low frequency AC, together with headphone reception.

The sensitivity of a telephone receiver was in itself sufficient to extend the range of reception of ordinary telegraphic signals. John Trowbridge at Harvard University in 1880 detected telegraph time signals at a considerable distance from the overhead line, being well away from the direct ground return path. Available references do not give specific distances, but Trowbridge's results were sufficiently encouraging to describe in a paper read before the American Academy of Arts and Sciences in 1880.

Not all early work depended solely on ground conduction. Mahlon Loomis reasoned that if the ground could be used for the return lead of a telegraph line, the atmosphere could serve as the transmitting line. His first public demonstration took place in 1866, with identical installations on two mountains 14 miles apart. Signals were sent from one kite-borne antenna to another by connecting the antenna at the transmitter to a galvanometer, which was earth connected. When the connection was established, the receiving galvanometer, already connected to antenna and ground, was observed to deflect.

Loomis conducted a number of later experiments, using balloons as well as kites to raise his antennas, and at a much later date was said to have used towers on two different mountaintops. His patent, granted in 1872, is very generalized in its description, and available information does not confirm that transmitted messages later supplanted the deflection signals of his first demonstration.

Just how Loomis managed to signal across a span of 14 miles initially, and even further during later tests, has generated some controversy. Several sources consider that an electrostatic method is most likely. It has been suggested that the atmospheric electrostatic field in the area was changed by the process of grounding the transmitter antenna. Whatever the actual process may have involved, Loomis was sufficiently encouraged by the results to advocate his system for many years, including unsuccessful efforts to finance a transoceanic wireless company.

Amos E. Dolbear for a number of years promoted another electrostatic system, using telegraphy in early work and a telephonic system later on, after applying for a patent in 1882. A physicist at Tufts College, Boston, he first used large capacitors at the transmitter and receiver antennas. He spoke of charging the earth using high voltage batteries connected from the capacitors to ground, with a microphone and telephone receiver also in the circuitry. Actually, he was raising the potential of the capacitor plates. Later he replaced the capacitors with kite-borne antennas, increasing the range and sending telephonic messages over a distance of half a mile. This was probably the earliest instance of wireless voice communication. He was said to have later reached a distance of 13 miles.

The only other investigator describing work with wireless telephony prior to about 1900 was Nathan Stubblefield, who may have tested a system using ground conduction as early as 1885. He made at least two private demonstrations to friends in 1892 over a distance of about half a mile, and continued experimenting for some years. His activities attracted little attention until after the turn of the century.

Work described up to this point depended upon conduction by ground or water, or possibly upon electrostatic phenomena. Another method also came into some use that relied upon induction. The transformer is a good example of inductive transfer of energy without physically connecting the input and output circuits. The principal disadvantage of the inductive method for communication is similar to the drawback associated with conduction: the distance between input and output wire arrays must be about the same or less than the dimensions of the arrays themselves, in order to transfer a useful amount of power.

Henry Preece began testing the induction method at an early date, as an alternative to conduction for proposed practical applications. Now working as an engineer for the British Post Office, and later as chief engineer, Preece developed both conductive and inductive techniques to the point where short-range wireless telegraphic systems were used between the English coast and one or two small offshore islands. Distances involved were generally less than about five miles, and wireless was used where cables were subject to damage by high seas. The development and application of these installations began in about 1882 and

continued for some 20 years. A few similar systems were installed by other engineers to service isolated lighthouses. These applications probably represent the high water mark for nonradiative wireless methods.

Contrary to the typical brief account of wireless development, documented communications-oriented work using the electromagnetic method was done even before Heinrich Hertz verified Maxwell's equations in 1888. David Edward Hughes, a British born scientist-inventor, was responsible for this early work, following his return to England after many years in the United States.

During the course of a number of experiments, he found that the spark observed when breaking an electrical circuit affected a telephone receiver. The latter was connected to the spark generator by a single wire. In October of 1879 he discovered that such sparks produced sounds in the receiver even without the wire connection. He showed his results to several scientists in late 1879 and conducted another demonstration in February of 1880. During this period he transmitted signals up to 500 yards, and is said to have walked along the street outside his laboratory while listening to the signal from his telephone receiver.

Hughes gave his 1880 presentation before a small group of visiting scientists from the British Royal Society. Unfortunately, the scientists incorrectly concluded that Hughes' system was using induction to transfer energy. Hughes was so disappointed that he made no further demonstrations until 1888. Even at this time, and himself a member of the Royal Society by then, he did not publish his results. Had he done so, the combination of equipment, successful wireless transmission, and the conclusion that sparks generated at the transmitter were radiating energy, would have given him the recognition that he deserved.

By the time that Hughes was again demonstrating his system in 1888, there were a number of others working in that field. However, with one exception these were scientists busily verifying Hertz' results and uninterested in the possibilities of communication. The exception was Nikola Tesla.

Tesla had opened a New York City laboratory in 1888 to resume previous work with alternating current at high frequencies. At least one source has suggested that his ideas about wireless transmission were in the formative stage at that time. What is known with certainty is the content of later lectures in 1892 and 1893, revealing the plan for his system. Somewhat later still, during the winter of 1894-1895 Tesla transmitted signals over short distances in his laboratory and to nearby locations. In mid 1897, he indicated during an interview that considerably greater distances had been bridged. In fact, it appears that his equipment had a range of at least 25 miles, resulting from tests conducted in a small boat traveling up the Hudson River from his New York City laboratory. There have been suggestions of much greater

Professor Adolf Slaby

to the antenna. His work attracted the interest of financial backers, and with aid from the German government itself, the Slaby-Arco Company was established. This was one of the firms that later merged to form Telefunken, Marconi's most formidable competitor.

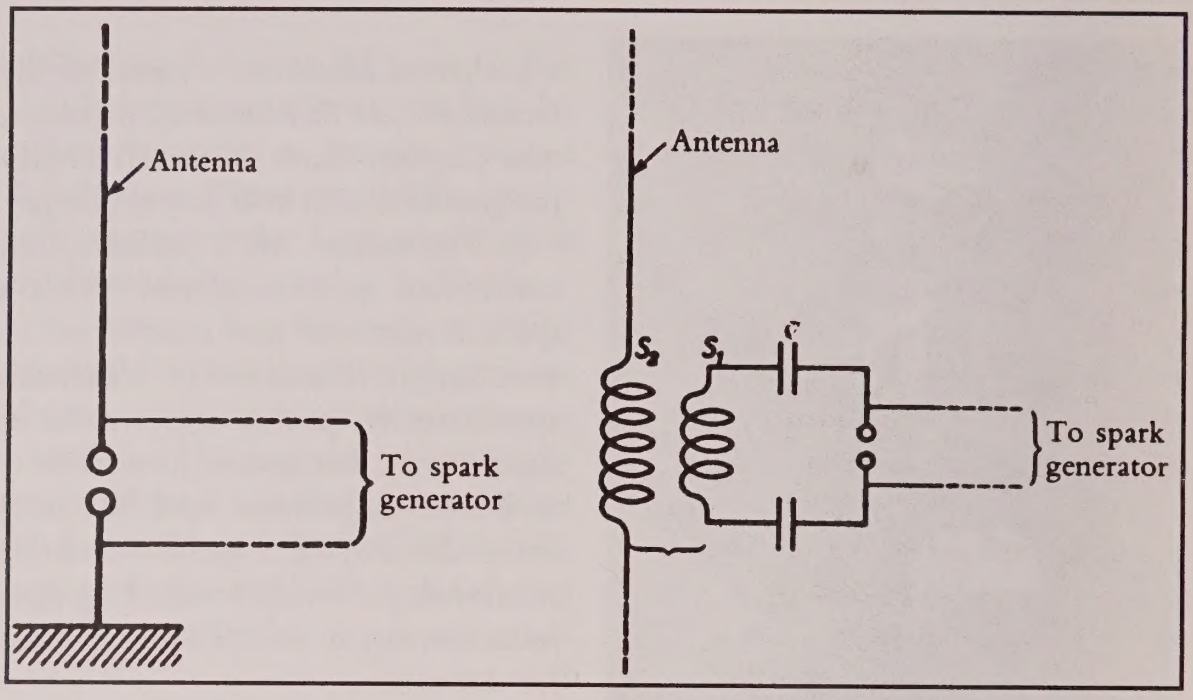
By the time that Marconi arrived in England in 1896, bringing his invention, Henry Preece was in a highly influential Post Office position and well experienced with the conduction and induction methods of communicating. He recognized the potential of spark-generated Hertzian waves at once, and gave Marconi his full support. Preece may have been more important to wireless development in this respect than in his earlier role of engineer and inventor. Also active at this time, and a backer of Marconi in terms of the technical side of Marconi's interests, was Captain (later Admiral) Henry Jackson of the British Royal Navy.

In December 1895, Jackson had conducted successful tests with a spark transmitter and receiver of his own design. When he saw Marconi's apparatus he quickly understood its significance, because of its similarity to his own. Jackson and Marconi soon developed a close working relationship, which resulted in later joint testing of wireless equipment for use at sea.

The independent work by Jackson was little known to the general public at that time and for many years thereafter. This was because of secrecy requirements of the military for the investigation of new inventions. Details in documents made available to the public in the 1960s show that Jackson had developed a practical system just a few months after Marconi.

The older forms of wireless were still affecting invention and innovation, even during the increasing work with Hertzian waves in the latter half of the 1890s. Among those promoting such activities was a group of German businessmen about to finance a new system using conduction through water. At that particular time, the group prudently decided to get an informed outside opinion before making a final decision.

At first glance this seems to be late in the day to have been considering nonradiative methods, since Marconi was already exceeding their best transmission ranges. However, there



Left, Marconi's transmitter (1895-1901); right, Braun's transmitter (September 1898).

was good reason for such consideration. Marconi was not continuing to get the same improvement in range that he initially experienced, as he increased transmitter power in his step-by-step development procedure. Now, an increase in power did not produce a proportional increase in range, and there was no explanation of why this was so. After all, theory predicted line of sight limits on transmission. Only Marconi's data suggested otherwise, the very data that were now revealing an unknown factor to consider. Thus there was cause to speculate that all wireless transmission methods might be limited to a short range.

Seeking a reputable and unbiased opinion about their system, the businessmen persuaded scientist Ferdinand Braun to help them. Braun had a long list of laboratory achievements to his credit, as well as an excellent teaching reputation, and had not previously been connected with commercial developments. Braun began a study of the conductive system and became interested in the practical problems of transmitting information. He was able to make significant improvements in the existing apparatus, particularly in the way that the transmitter was coupled to the antenna.

It was not too long before it occurred to Braun that his improvements were also applicable to the transmission of Hertzian waves. From that point on, he concentrated on the electromagnetic method, making rapid progress. He found that his new way of inductively coupling the transmitter to the antenna eliminated the apparent range limitation that Marconi was experiencing. Providing optimum coupling is taken for granted nowadays, but at that time it was a fundamental advance in the understanding of alternating

Ferdinand Braun

currents. In fact, the patent resulting from this work had the effect of breaking a brief monopoly that Marconi had established covering transmitter circuitry. The resulting commercial venture, based on transmitter designs by Braun together with Adolf Slaby's company, were later merged into Telefunken, the chief worldwide competitor with the Marconi Company. Some years later, Marconi and Braun shared the Nobel Prize in Physics for their contributions to wireless.

The major participants in the first generation of wireless systems were operating by 1900, with the notable exception of one company in the United States, United Wireless. The latter firm would not become important for several years, while it was growing at the expense of a number of small American companies. Even it would eventually be absorbed into the Marconi organization. Nevertheless, the fact that other men and other companies were already influential by the turn of the century helps explain why the Marconi Company never achieved its goal of a lasting monopoly. This in spite of the fact that Marconi was first in establishing a practical wireless system. Finally, it was the rapid expansion of all of the first generation companies that brought a quick end to development of earlier methods with their major limitations.

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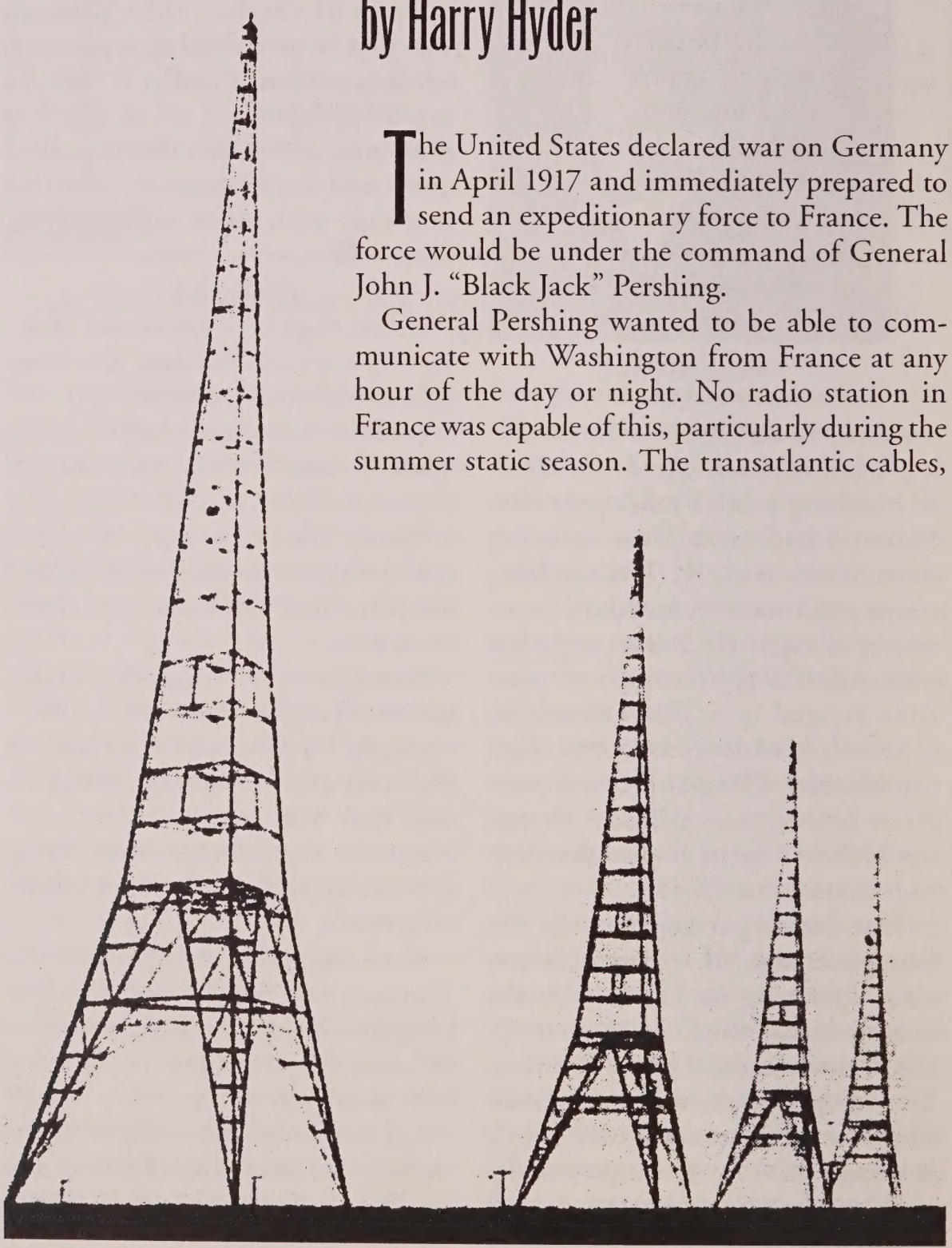
The Lafayette RadioStation

by Harry Hyder

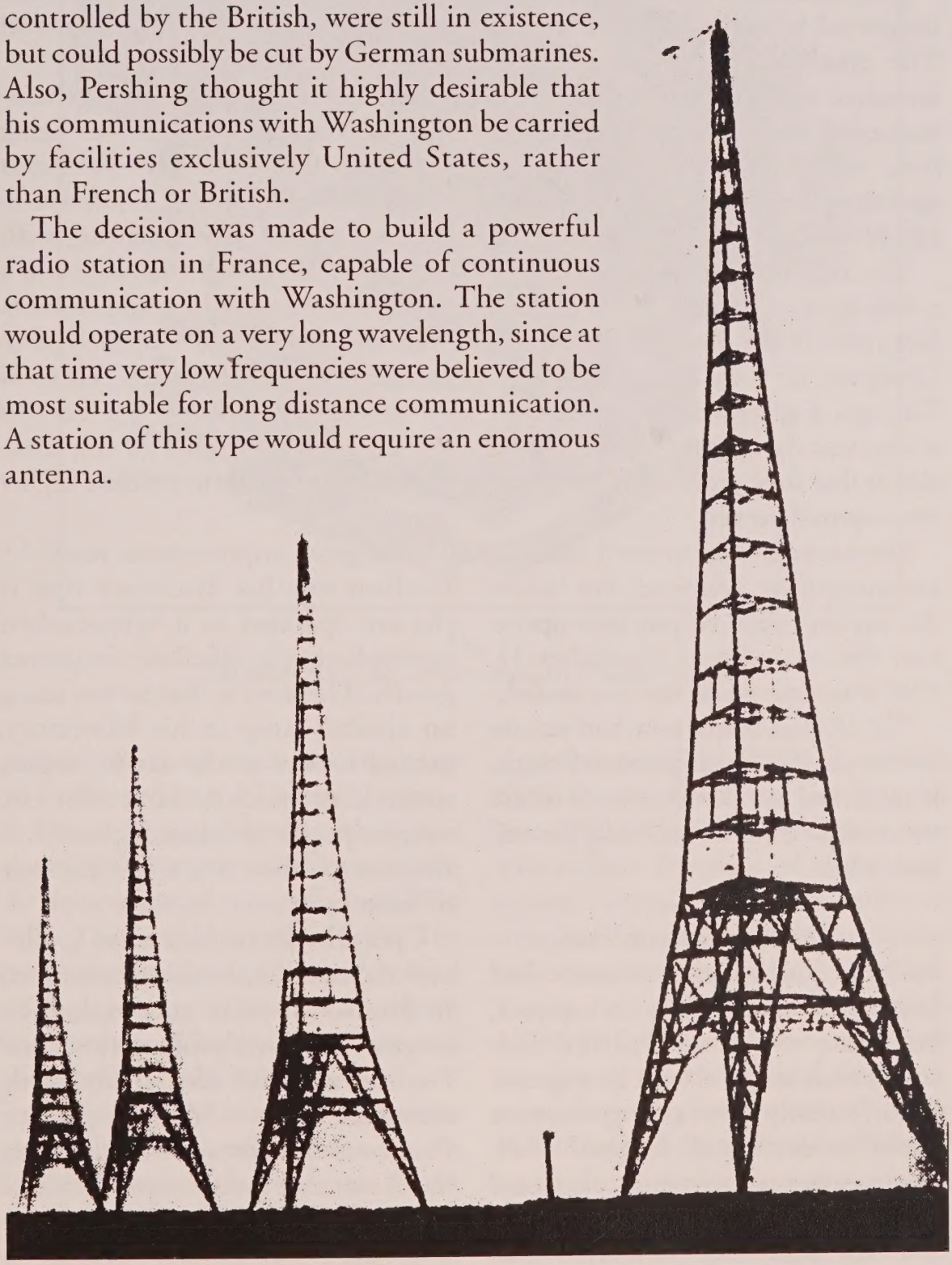
The United States declared war on Germany in April 1917 and immediately prepared to send an expeditionary force to France. The force would be under the command of General John J. "Black Jack" Pershing.

General Pershing wanted to be able to communicate with Washington from France at any hour of the day or night. No radio station in France was capable of this, particularly during the summer static season. The transatlantic cables,



controlled by the British, were still in existence, but could possibly be cut by German submarines. Also, Pershing thought it highly desirable that his communications with Washington be carried by facilities exclusively United States, rather than French or British.

The decision was made to build a powerful radio station in France, capable of continuous communication with Washington. The station would operate on a very long wavelength, since at that time very low frequencies were believed to be most suitable for long distance communication. A station of this type would require an enormous antenna.



The station would be located near Bordeaux, far from any combat area. The U.S Navy would design the station, since it had the most experience in the design of high-power radio stations.

The antenna was an inverted L, supported by eight 835-foot towers. The measured capacitance of the antenna was 50,000 pF, and the measured resistance, radiation plus loss, was 1.6 ohms. The chosen operating frequency was 15.8 kHz, 18940 meters.

The transmitter itself would be a one-megawatt arc, to be manufactured by the Federal Telegraph Company of Palo Alto, California. The arc, a generator of continuous waves, was the only transmitter available at that time capable of generating the required power.

The antenna was erected and the arc transmitter delivered, but before the station could be put into operation the armistice of November 11, 1918 was signed and the war ended.

The United States now had no use for the station. It was given to France. It remained in operation with its arc transmitter until 1934, using the call letters LY.

The Arc Transmitter

The original work with radio had been done using spark techniques, but some engineers realized that continuous waves would be superior if sufficiently powerful generators could be developed. Reginald Fessenden was a pioneer, and contracted with General Electric Co. to supply a rotary high-frequency alternator. In 1906 he received a unit capable of one-kilowatt output at 50 kHz. He modulated this using a battery of carbon microphones and achieved what probably was the first successful radiotelephone broadcast. GE continued development of the alternator and by 1917 had a unit producing 200 kW.

Another approach to the generation of continuous waves was being pursued in Denmark by Valdemar Poulson. Earlier, Elihu Thomson in England, while experimenting with arc lights, had noted that an arc in a strong magnetic field could develop high frequencies when connected to inductance and capacitance. He went no further. Poulson carried on this work, made a number of improvements, and was able to produce higher power.

One great improvement made by Poulson was his discovery that if the arc operated in a hydrocarbon atmosphere, the efficiency improved greatly. The story is that he was using an alcohol lamp in his laboratory, carried it over to the arc to inspect something, and noticed that the output power increased greatly. If this story is true, it is a fine example of serendipity.

Cyril Elwell, an Australian graduate of Stanford, became interested in Poulson's work, and backed by several Stanford professors visited Poulson with the idea of obtaining American rights to Poulson's patents. Poulson asked for more money than the American group was capable of raising. However, Elwell was able to negotiate a smaller cash payment by

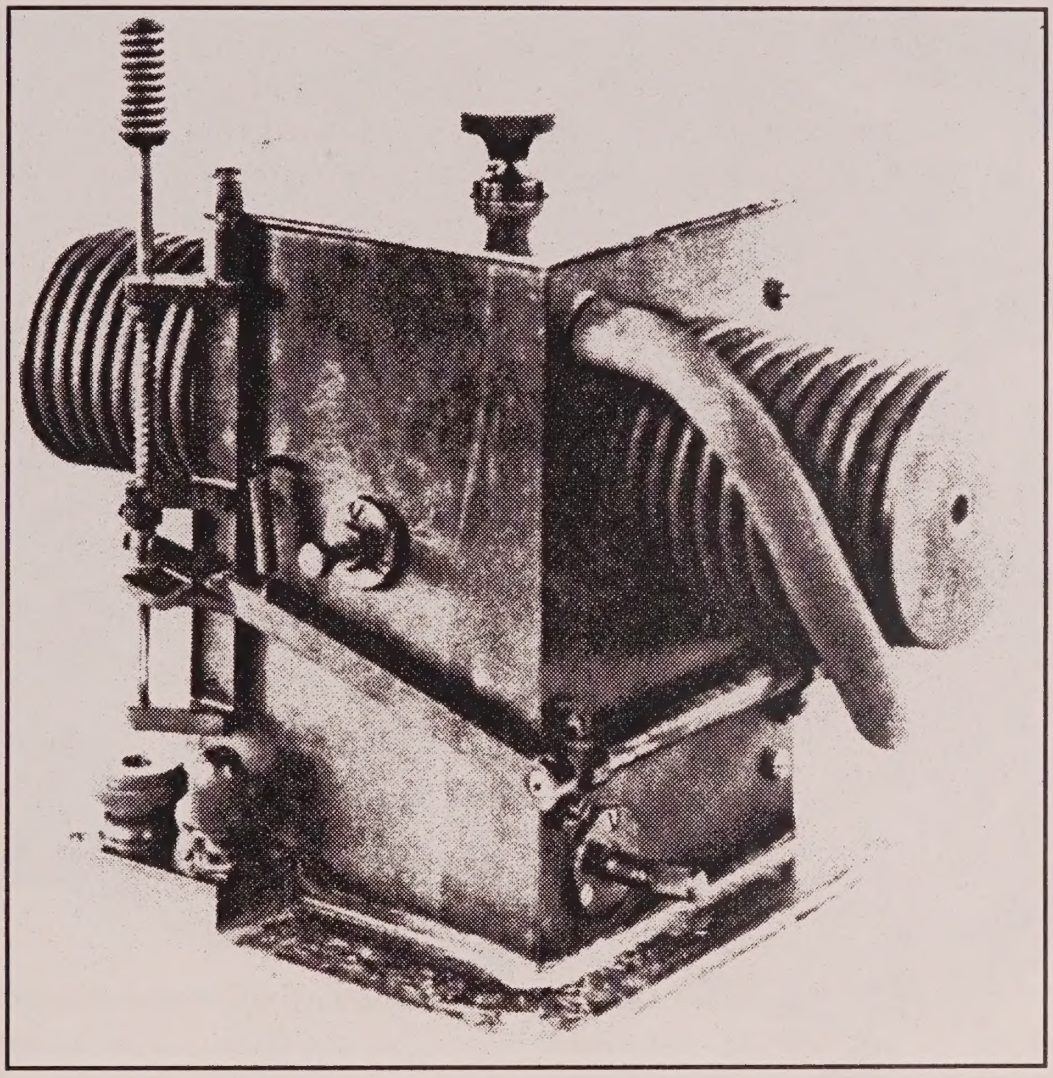


Fig. 1
100 Watt Arc Converter made by Poulsen in 1909

offering Poulson stock in a company to be formed in the United States.

Elwell brought back with him a small 100-watt arc converter, which he demonstrated successfully in Palo Alto. This unit is shown in fig. 1. The success of the demonstration enabled enough money to be raised to form the Poulson Wireless Telephone and Telegraph Co. in 1909.

Additional Poulson arc converters were obtained and stations set up in Stockton and Sacramento. These were 12 kW units, and successful communication between them was demonstrated in 1910. A station then was set up in the Los Angeles area, 350 miles away. This was also successful. Because of these successes, financing became easier to obtain. The name of the company was changed to the Federal Telegraph Company in 1911. Poulson was given $500,000 for exclusive rights to his patents in the United States. A manufacturing facility was set up in Palo Alto and from then on Federal made all its own equipment.

Cyril Elwell believed that the Poulson arc's efficiency and reliability

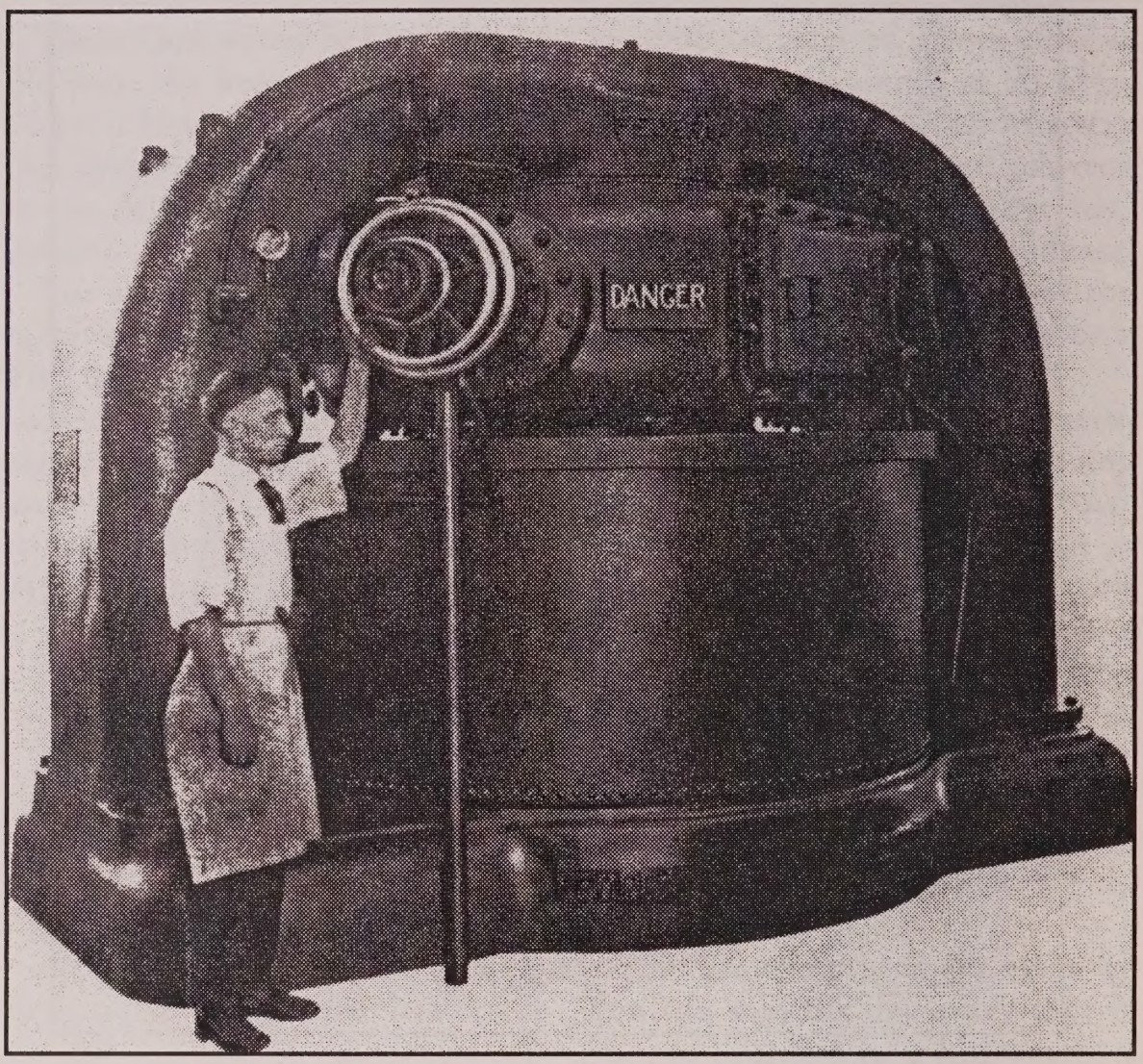


Fig. 2
1000 kW Federal Arc Converter

could be greatly improved. He hired Leonard Fuller, a recent Cornell graduate, to study arcs and make improvements.

The basic idea of Federal Telegraph was to provide a commercial telegraph service. Several stations were set up in West Coast cities and Federal opened for business. They were able to provide service for two-thirds of the cost of Western Union or Postal Telegraph. Federal also installed 100 kW stations in San Francisco and Hawaii. They communicated reliably. This was quite an accomplishment.

In 1912, the Navy was conducting acceptance tests of a 100 kW spark transmitter supplied by Fessenden. This was at NAA, the Navy station at Arlington. Cyril Elwell obtained permission to test one of his 30 kW arc transmitters alongside the spark unit. The arc unit outperformed the spark unit, communicating with the San Francisco station and also the Hawaii station. These distances were unheard of at the time, and the Navy immediately became interested.

The Navy immediately began buying arc transmitters from Federal.

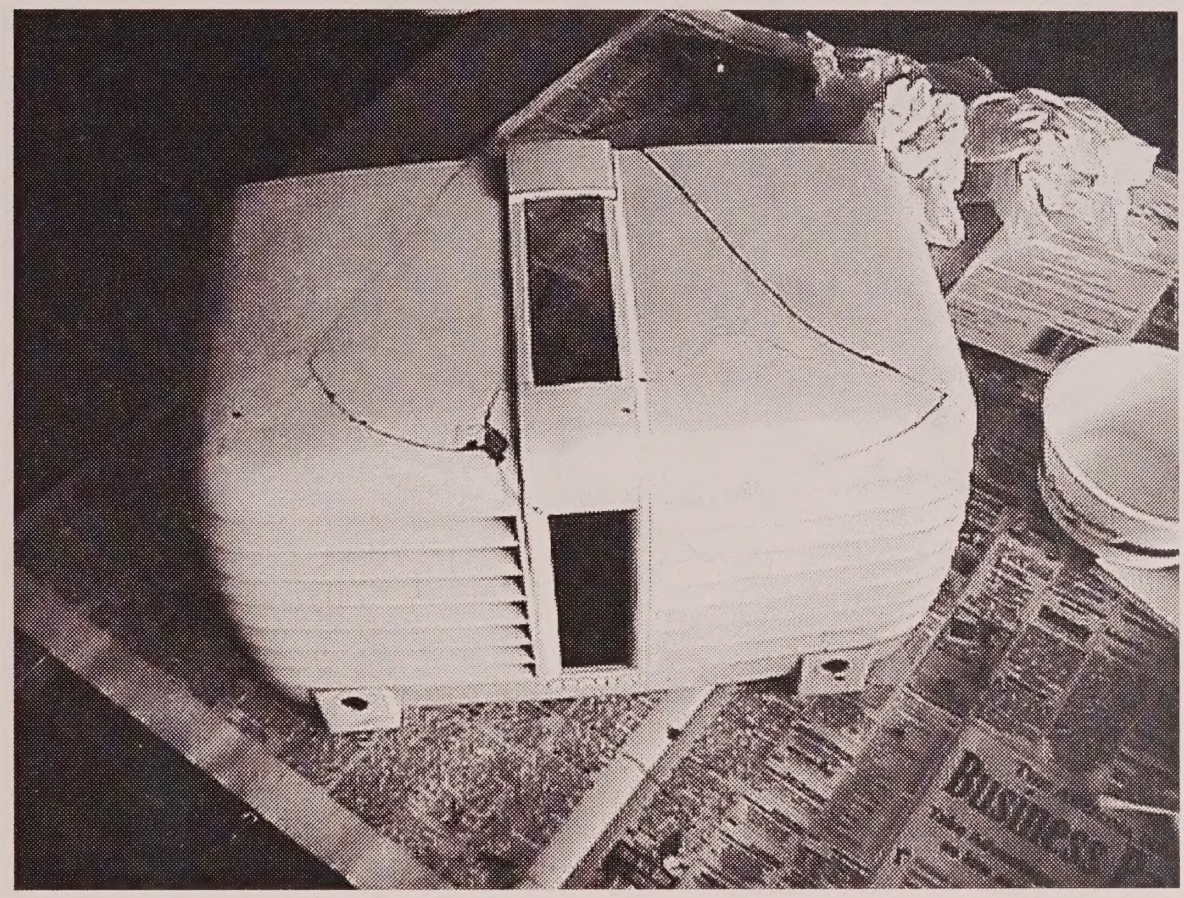


Fig. 2

- Bondo epoxy body filler, small can
- Scotch tape
- Small roll of gauze bandage
- Sand paper, 100, 220, 400 and 800 grits
- Several small clip on clamps
- Wax paper
- Paper towels
- Cotton swabs
- Alcohol

Clean up the major pieces with soap and water and dry thoroughly. Set the pieces out in the manner that they will go together, this was done in Fig. 1. Locate any split or cracked pieces. A piece that has a split to an edge can be glued by offsetting the two sides of the split at the edge and applying liquid super glue to both sides of the split, allowing some to sink into the end part of the split, then pressing the split pieces together. They will usually snap into place. Hold in place while the glue sets. Before pressing them together wrap a small piece of wax paper around the edge so your fingers do not become part of the case.

If the damage is one or two chunks missing from the main body try fitting them in place. If you feel that they will go together without repositioning, use the super glue gel, otherwise use the 5 minute epoxy which gives enough working time to position them properly. Hold them in place while the epoxy sets up.

For the extensive damage as pictured start with the large pieces for the bottom and work your way up.

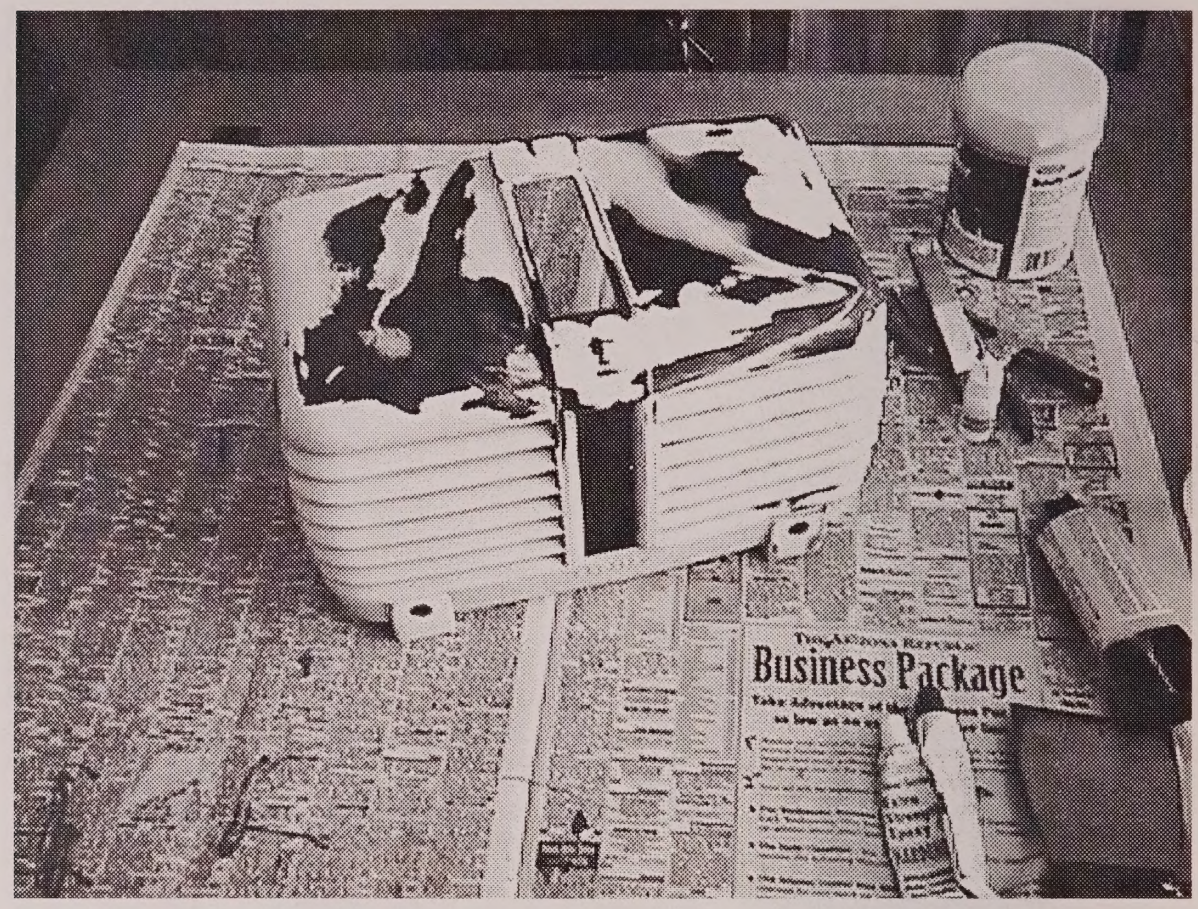


Fig. 3

Insure that the pieces will fit properly before mixing and applying the 5 minute epoxy. Apply a thin coat to each side to be glued, trying not to get epoxy on an area that another piece will fit into later. Fit the pieces together and if possible wipe off any excess epoxy on the outside of the case with a paper towel and alcohol. Use a cotton swab and alcohol to remove any on open edges and hold the joint until the epoxy sets.

Now set everything aside for six or more hours to insure that nothing goes awry when the next piece is put in. Check the fit of the remaining pieces as you build up the case and let it stand long enough between pieces so that the epoxy achieves a good portion of its final strength before proceeding.

Fit in any small pieces that go between the large pieces as you go. Large pieces that join at the back edge of the case may be clamped with the small clip ons, use wax paper under the clamps to prevent them from being glued in place.

Soon you should have something resembling fig. 2, a glued together case requiring filling and sanding. Any holes remaining may be filled now. On the inside of the case place a piece of Scotch tape over the hole, mix some Bondo for small holes, or epoxy for larger ones and fill from the outside of the case, the tape keeps it from falling through.

Use a knife blade or putty knife to shape the Bondo. Scotch tape applied over an epoxy filled hole will form it to simple curves. Where there is

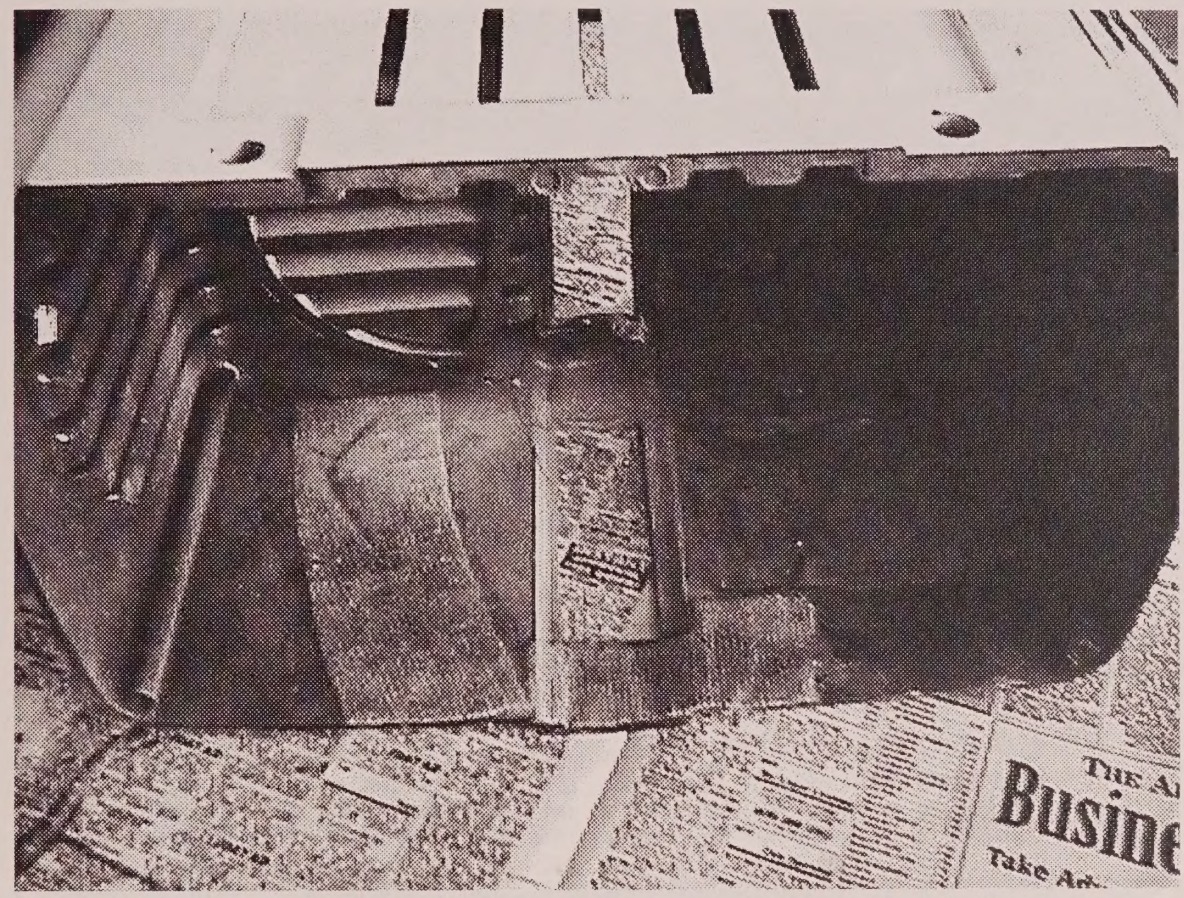


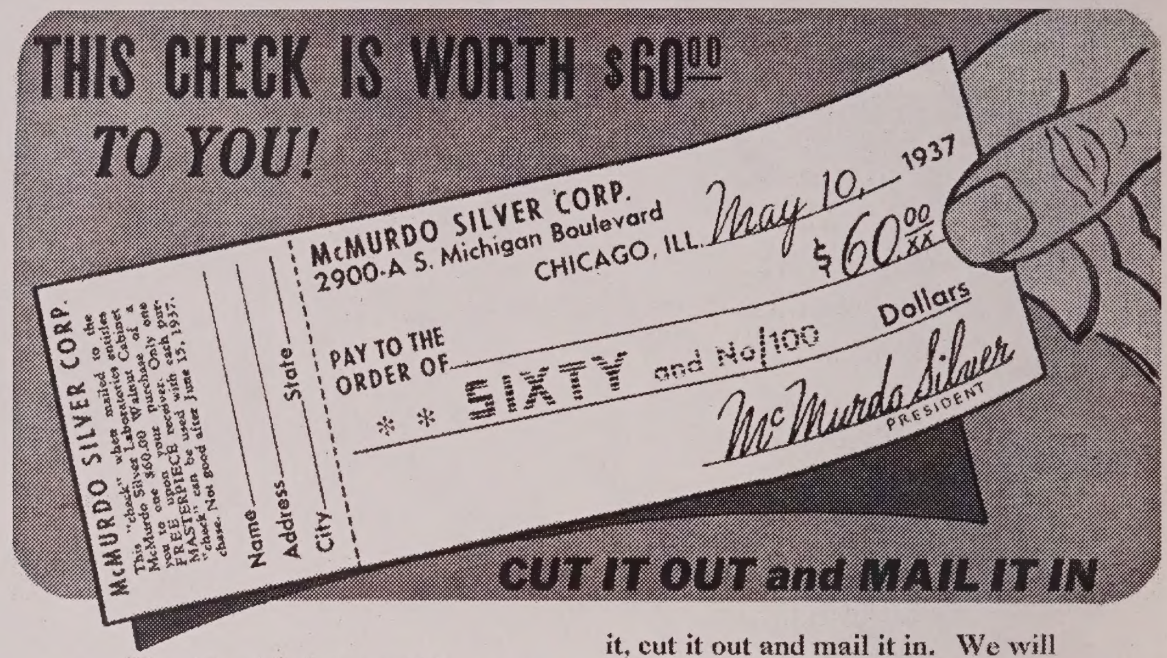
Fig. 4

a step between the edges of a joint, use the 100 grit sand paper and a sanding block to reduce the step and keep the case shape. Use the 100 grit paper to prepare the surfaces of any area requiring filling and clean with alcohol and a paper towel.

Prepare some Bondo and apply to the cracks and surface areas to be filled. Large areas may require several mixes as it sets up rapidly. After all is well set use the 220 grit paper and a sanding block and sand, sand, sand, being careful to follow the case contours. Your case should start looking like fig. 3.

At this time you may find areas of the case that you feel could use a little strengthening. Look at fig. 4 and you will see two areas inside the case that have gauze epoxied to the inside. Use 100 grit paper to rough up the inside surface and clean with alcohol. Cut a piece of gauze to fit the area to be strengthened and mix a good bit of the 30 minute epoxy. Cover the area with a layer of epoxy and work the gauze into the epoxy so that it matches the inside case contour. Apply another layer of epoxy to the gauze and set aside to cure.

Finish the case by sanding with the finer grits and fill any nicks or low spots found during sanding, remember to clean well before filling. Soon the case should be ready to paint. Use a sanding sealer first and sand again as required. With a little luck and a lot of patience and sanding your finished case will look brand new and you will have turned a disaster into a work of art.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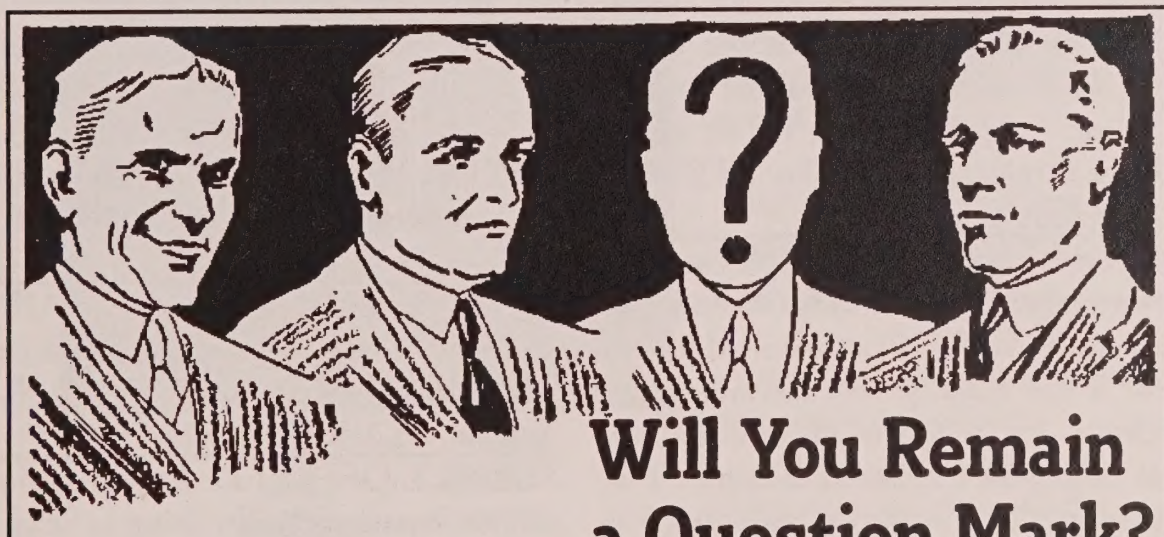

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If you are interested in displaying any of your old radios or radio related gear in the Pine, AZ Historical Museum for a few days, please contact Andy Ooms, (520) 476-6124, or email me at oomspine@cybertrails.com. The exhibit idea is tentative, meaning it is not guaranteed to happen.

WANTED: Radio Premiums. Rings, paper, badges, etc. from Tom Mix, Lone Ranger, Orphan Annie, Amos 'n Andy, etc. LARRY STENCEL, 9176 N. 115th Pl., Scottsdale, 85259, 661-6722.

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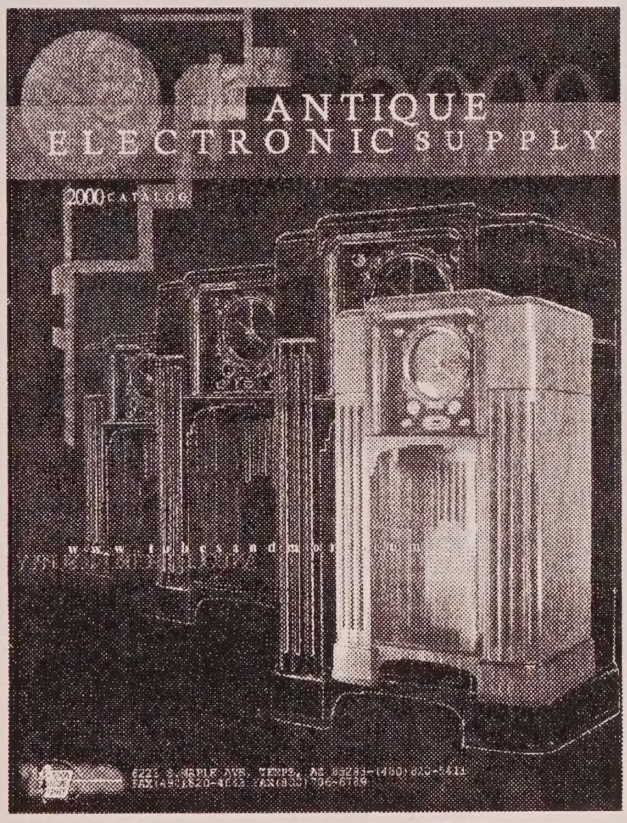

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Items marked * could be subjects for regular features, if you are willing to make a committment. Submissions can be typed or on computer disk (any format is OK), or emailed. Call or write the editor:

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